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(54) PRESSURISED DISPENSERS FOR HYPOCHLORITE FOAMS

(71) We, WILKINSON SWORD LIMITED, a British Company, of Sword Works, Southfield Road, London W.4., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the production of hypochlorite ion-containing foams such as are useful, for example, in the treatment of burns and scalds and other skin lesions, and to a pressurised dispenser for such foams.

Hypochlorite ion-containing foams are of considerable value in the treatment of burns, scalds and other skin lesions. Such foams usually comprise an aqueous foam or foamable base, e.g. an aqueous soap solution, containing a water-soluble source of hypochlorite ions. Because of the chemical instability and reactivity of the hypochlorite ion it is generally necessary to keep the hypochlorite ion source and the foam or foamable base apart until the instant of use. One way of achieving this is by means of a pressurised dispenser of the so-called aerosol type equipped with a foam nozzle and valve assembly and containing two separate compartments exposed to the pressure of a pressurised propellant and each communicating with the foam nozzle via the operating valve, one of said compartments containing a foam or foamable base, e.g. an aqueous soap solution, and the other a liquid containing a source of hypochlorite ion, e.g. an aqueous solution of lithium hypochlorite. Upon opening of the valve the contents of the two compartments are co-dispensed through the foam nozzle to provide the hypochlorite ion-containing foam. One such arrangement is disclosed in our copending U.K. Patent Application Number 34944/70 (Serial No. 1 367 075) and comprises a pressurised dispenser having an inner flexible bag or envelope suspended therein and containing a liquid source of hypochlorite ions separated from an aqueous soap solution contained in the body of the container. Whilst such an arrangement operates satisfactorily, the construction and assembly of the dispenser is complex and relatively expensive.

The present invention seeks to provide a much simpler and more economic form of hypochlorite foam dispenser.

The dispenser according to this invention comprises a container equipped with a manually operable valve and containing a foam or foamable base composition under pressure of a pressurised propellant. Mounted externally of the valve is a foam dispensing head having a nozzle for the discharge of the foam, when the valve is opened, and a reservoir space formed therein adjacent the nozzle, or a flow passage leading thereto, said reservoir space having packed therein and substantially filling said space a solid material capable of releasing hypochlorite ions into the foam when in contact therewith, said reservoir being so positioned that on its way to the discharge nozzle from the container, the foam passes over the surface of said solid material thereby to entrain a quantity of hypochlorite ions into the foam.

As will be appreciated, the construction of the pressurised container is considerably simplified in the above arrangement and, indeed, can be a conventional single compartment pressurised container equipped with a conventional valve assembly sealed to the neck of the container and having a vertical hollow valve stem projecting upwardly from the valve assembly and a dip tube extending downwardly into the interior of the container.

In a preferred arrangement according to the invention the foam dispensing head comprises a cap of moulded plastics ma-

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terial frictionally received on the upper end of the valve stem. The reservoir containing the source of the hypochlorite ions may be in a variety of different forms depending on the nature of the hypochlorite ion source used. For example, the reservoir can take the form of a recess or depression in a wall of a flow passage through the dispensing head into which recess or depression is packed the solid hypochlorite ion source. In this arrangement, the foam dispensed from the valve flows over the surface of the hypochlorite ion source on its way to the discharge nozzle thereby to entrain a quantity of the hypochlorite ion source material.

Alternatively, the hypochlorite ion source may be a liquid, in which case it will be absorbed on a porous support, the porous support forming a lining to the discharge passage, over which lining the foam flows on its way to the discharge nozzle thus entraining a quantity of the liquid hypochlorite ion source. In another arrangement, the hypochlorite ion source may be absorbed upon a powdered material and the foam caused to flow through the source material packed into the discharge passage between suitably positioned perforated or porous retaining members.

The invention will be further described with reference to the drawing accompanying the provisional specification.

In the drawing there is shown a pressurised dispenser fitted with a foam dispensing head, shown in section, it being understood that this is merely a diagrammatic representation for the purpose of illustrating the principle of the present invention.

The dispenser illustrated comprises a container 1 containing a soap or detergent solution under pressure of a gaseous propellant e.g. butane. A conventional valve means (not shown) having an upstanding hollow valve stem 2 is mounted in known manner in the upper end of the container. Downward pressure on the valve stem 2 serves to open the valve and permit the discharge of the contents of the container 1 through the valve stem 2 in a manner well known *per se*. The sudden release of pressure will cause the soap solution to foam as it is discharged through the valve stem.

Mounted on the upper end of the valve stem 2 is a foam dispensing head 3 according to the present invention. The dispensing head 3 comprises a downwardly open socket 4 frictionally engaging over the upper end of the valve stem 2. Leading from the socket 4 to a discharge nozzle 5 is a discharge passage 6. As shown, the discharge passage 6 is of a simple J-configuration. However, the discharge passage 6 may, and probably will, in practice, be of a much more torruous configuration e.g. a spiral, the reason for this being explained subsequently.

According to the present invention, the upper part of the dispensing head is extended upwardly to form a reservoir 7 which opens directly onto the discharge passage 6 over a substantial part of its length. Into this reservoir 7 is packed a solid material 8 containing hypochlorite ions, or a compound which will yield hypochlorite ions, and capable of releasing such ions into the stream of foam which will be discharged through the discharge passage 6 from the container 1 upon opening of the valve. By selection of an appropriate solid material 8 a controlled release of hypochlorite ions into the foam can thus be obtained.

A tyical and preferred hypochlorite ion-producing composition usable according to the invention is lithium hypochlorite or 5,5-dimethyldichlorohydantoin. These may be packed, in powder form, into the recess 7 using a binding agent, such as sodium stearate, sodium benzoate or a water-soluble polymer. If desired to facilitate packing a small quantity of water may be added.

Control of the hypochlorite ion concentration in the foam can be effected in various ways. In one way a hypochlorite ion source is used which is of limited solubility in water, e.g. 5,5-dimethyldichlorohydantoin. The area of the hypochlorite ion source in contact with the foam is then adjusted so that sufficient source material is transferred into the foam during the period of contact with the hypochlorite ion source to saturate the solution. Alternatively or additionally, a source material can be used which dissolves in or admixes with water only slowly or which releases hypochlorite ion only slowly. The hypochlorite ion concentration in the foam can then be controlled by adjustment of the rate of foam emission, the nature of the binder, if any, used to pack the hypochlorite ion source into the reservoir, the the selection of the source material itself and the structural design of the dispensing head. In either case, the structural design of the dispensing head will be important, it being necessary to ensure that the foam is in contact with a sufficiently large area of the source material or is in contact with the source material for a sufficient length of time to achieve transfer of the desired amount of hypochlorite ion from the reservoir to the foam. The shape of the reservoir and the configuration of the discharge passage will also be important in ensuring that, as the hypochlorite ion source material in the reservoir is depleted, the rate of transfer into the foam will be substantially constant. Generally speaking, as long contact path as possible within the confines of the dispensing head will be provided.

Other sources of hypochlorite ion include alkali metal hypochlorites other than the lithium compound already referred to, in-

organic acids such as N-chlorosulphamic acid, N,N-dichlorosulphamic acid, N-chloroimidodisulphonic acid and their salts, trichloroisocyanuric acid, dichloroisocyanuric acid N-chlorosuccinimide, chloroazodin, N-chloroanilides, N-chlorosulphonamides, 1,3,5 - trichloro - 2,4 - dioxohexahydrotriazine, chlorinated melamine and N-chloroazodicarbonamide.

When used as a medical and/or veterinary dressing certain mechanical and physical properties of the foam are desirable. Desirable mechanical properties are that the foam will deform under gentle pressure without breaking into islands but will not deform under the force of gravity and so will remain where placed. Thus, when applied as a dressing to the skin of a patient such mechanical properties allow the patient a degree of movement not permitted by conventional dressings. Desirable physical properties of the foam are that it will not dry out or collapse appreciably during a period of, for example, six hours. With such a foam a dressing is provided which is applied readily with little or no pain, is comfortable when in place and yet may be removed with little or no discomfort by gentle washing. Whilst in place, the foam may serve to control existing infection and to act as a barrier against further infection. The hypochlorite ion will serve to effect the dissolution of proteinaceous materials in addition to having germicidal and fungicidal properties and will thus aid healing in instances such as burns, scalds and lesions following mechanical injury and in gangrenous and other conditions where dead tissue is present.

As soap solutions there may be used aqueous solutions of one or more long chain saturated fatty acids and one or more alkali metal hydroxides, with a preferred pH range from 7.5 to 11.0, and even more preferred from 8.5 to 10.0. Examples of such fatty acids are stearic and/or myristic and/or lauric acid. As commonly understood in soap technology the stearic acid may contain up to 40% of other fatty acids, especially palmitic acid. Preferred alkali metal hydroxides are potassium and/or lithium hydroxide. The soap solution may also contain a small amount of sodium carboxymethyl cellulose or a long chain tertiary amine N-oxide such as dimethylhexadecylamine N-oxide, dimethylcocoamine N-oxide or dimethylhydrogenated tallow amine N-oxide, to improve the stability and the mechanical properties of the foam.

The concentration of the hypochlorite ion must not fall rapidly following formation of the foam. With the preferred soap solutions reactions of the hypochlorite ion with the soap constituents does not lead to rapid loss of available chlorine or to the organic substances in the foam composition being converted so that the physical and mechanical properties of the foam are changed. Desirably the proportion of available chlorine in the foam is from 0.01% to 1.8% ("available chlorine" referring to oxidising power and being represented by the ability to liberate iodine from hydrogen iodide).

Although aqueous soap solutions are the preferred foamable base compositions used the present invention other aqueous compositions containing a suitable detergent or surfactant can be employed.

Suitable pressurising agents are hydrocarbons such as butane, isobutane and propane, in weight proportion to the total contents of from 3.5 to 4.5%, or fluorocarbons in weight proportion to the total contents of from 7.0 to 10.5%, preferably a mixture of dichlorodifluoromethane and dichlorotetrafluoroethane in weight ratio of 40:60, or equivalent molar proportions of other fluorocarbon propellants.

Instead of using a solid hypochlorite ion source as particularly described above, ie a powder in combination with a binder other solid forms will be usable subject a) to their being packable and retainable within the reservoir, and b) their being capable of releasing hypochlorite ion or a hypochlorite ion-producing precursor into the foam as it flows through the discharge passage. The hypochlorite ion source may therefore be formulated as a gel or a stiff paste or it may even be in liquid form absorbed upon a suitably porous carrier.

Because of the tendency of many hypochlorite ion sources to lose available chlorine in contact with air, the dispensers provided in accordance with the invention, when containing a hypochlorite ion source and a foam producing solution as described, will preferably be provided with some form of removable seal to protect the hypochlorite ion source from atmospheric oxygen during storage. Also, as the dispenser will be used intermittently over a period of time and not usually in a single shot application, a foam trap will generally be provided within the dispensing head.

WHAT WE CLAIM IS:—

1. A hypochlorite ion-containing foam dispenser comprising a container equipped with a manually operable valve and containing a foam or foamable base composition under pressure of a pressurised propellant, and a foam dispensing head mounted externally of the valve, said foam dispensing head having a nozzle for the discharge of the foam, when the valve is opened, and a reservoir space formed therein adjacent the nozzle, or a flow passage leading thereto, said reservoir space having packed therein and substantially filling said space

a solid material capable of releasing hypochlorite ions into the foam when in contact therewith, said reservoir being so positioned that on its way to the discharge nozzle from the container, the foam passes over the surface of said solid material thereby to entrain a quantity of hypochlorite ions into the foam.

2. A dispenser according to claim 1, wherein the source of hypochlorite ions is or contains powdered lithium hypochlorite or 5,5-dimethyldichlorohydantoin packed into said reservoir with the aid of a binding agent.

3. A dispenser according to claim 1 or 2, wherein the foamable base composition comprises an aqueous soap solution.

4. A dispenser according to any one of the preceding claims, wherein the dispenser comprises a single compartment container having a valve assembly sealed in the neck of the container, said assembly comprising a hollow valve stem projecting upwardly from the valve assembly, and wherein the foam dispensing head comprises a cap of moulded plastics material frictionally received on the upper end of the valve stem and having formed therein by moulding said reservoir space into which is packed said solid material capable of releasing hypochlorite ions.

5. A dispensing head, for use with a pressurised dispenser comprising a cap of moulded plastics material having a socket adapted to receive the upper end of a hollow valve stem, a nozzle, a discharge passage extending between said socket and said nozzle and a reservoir space moulded therein adjacent and in open communication with said nozzle or said discharge passage, and packed into and substantially filling said space a solid material capable of releasing hypochlorite ion into fluid material flowing through said nozzle and discharge passage.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.